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EXAMINER	
UMEZ ERONINI, LYNETTE T	
ART UNIT	**PAPER NUMBER**
1765	

DATE MAILED: 10/04/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/616,098	CHEN ET AL.	
	Examiner	Art Unit	
	Lynette T. Umez-Eronini	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 July 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-29* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-29* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *08 July 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *7/8/03*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

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DETAILED ACTION

Claim Objections

1. Claims 27 and 28 are objected to because of the following informalities: There are two sets of claims. Appropriate correction is required.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1-4 and 6-11 are rejected under 35 U.S.C. 102(b) as being anticipated by Shi et al. (US 6,265,320 B1).

Shi teaches a method of removing material in a semiconductor structure in which a patterned photoresist layer **18** overlies hardmask layer **16** and insulating material **14** (which is the same as applicants' OARC) and layer **14** comprises organic polymers and is etched using one or more of an inert gas, such as argon, helium, or nitrogen; methane (CH_4); and hydrogen (column 2, lines 30-67). The aforementioned reads on,

A method for etching an organic anti-reflective coating (OARC), comprising:

(a) providing a substrate having an organic anti-reflective coating (OARC) thereon;

(b) forming a patterned mask on the organic anti-reflective coating (OARC); and

(c) etching the organic anti-reflective coating (OARC) using a gas mixture comprising at least one of a hydrocarbon-containing gas and an oxygen-containing gas, in **claim 1**;

wherein the oxygen-containing gas is selected from the group consisting of oxygen (O_2), carbon dioxide (CO_2), carbon monoxide (CO) and sulfur dioxide (SO_2), **in claim 2**;

wherein the hydrocarbon-containing gas has a formula C_xH_y where x and y are integers, **in claim 3**;

wherein the hydrocarbon-containing gas is selected from the group consisting of methane (CH_4), ethylene (C_2H4), ethane (C_2H_6) and ethylyne (C_2H_2), **in claim 4**;

wherein the gas mixture further comprises an inert gas, **in claim 6**; and

wherein the inert gas comprises one or more gases selected from the group consisting of nitrogen (N), argon (Ar), helium (He) and neon (Ne), **in claim 7**.

Since Shi illustrates the same method and materials in etching antireflective coating material then using Shi's method in the same manner as claimed by applicants would result the same wherein the gas mixture comprises the hydrocarbon-containing gas and the inert gas at a hydrocarbon-containing gas:inert gas flow ratio within a range of about 30:1 to about 3:1, **in claim 8**;

wherein the gas mixture comprises the oxygen-containing gas and the inert gas at an oxygen-containing gas:inert gas flow ratio within a range of about 5:1 to about 1:5, **in claim 9**;

wherein step (c) further comprises: providing the hydrocarbon-containing gas and the inert gas at a hydrocarbon-containing gas:inert gas flow ratio of about 20:1 to 3:1; maintaining the substrate at a temperature of about 10 to about 60 degrees Celsius; applying a plasma power of about 500 W to about 1200 W; applying a substrate bias power of about 50 W to about 200 W; and maintaining a process chamber pressure within a range of about 1 mTorr to about 30 mTorr, **in claim 10**; and

wherein step (c) further comprises: providing the oxygen-containing gas and the inert gas at an oxygen-containing gas:inert gas flow ratio of about 5:1 to 1:5; maintaining the substrate at a temperature of about 10 to about 60 degrees Celsius; applying a plasma power of about 500 W to about 1200 W; applying a substrate bias power of about 50 W to about 200 W; and maintaining a process chamber pressure within a range of about 1 mTorr to about 10 mTorr, **in claim 11**.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein

were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shi (US 320 B1) as applied to claim 1 above, and further in view of Hopper et al. (US 6.395,644 B1).

Shi differs in failing to teach the organic anti-reflective coating (OARC) comprises a material selected from the group consisting of polyamide and polysulfone.

Hopper teaches anti-reflective coatings are conventionally made of various materials, including organic and inorganic materials. Organic materials conventionally employed for ARCs include spin-on polyamides and polysulfones. The effective use of an ARC enable patterning, and alignment without reflective interference from the surface of the underlying layer (column 1, lines 49-58).

Hopper illustrates that organic materials such a polyamides and polysulfones, which are used as antireflective coatings are known. Hence, it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to employ Hoppers' antireflective coating to achieve the claimed invention for the purpose preventing interference of light from the surface of an underlying layer.

Claim Rejections - 35 USC § 102

7. Claims 12-15 and 17-24 are rejected under 35 U.S.C. 102(b) as being anticipated by Liu et al. (US 6,297,158 B1).

Liu teaches manufacturing an integrated circuit (column 1, lines 7-11) and provides substrate **200** with metal layer **210** and blanket dielectric material **220** (which is the same as applicants' OARC), which is preferably an organic polymer (column 1, line and column 6, lines 34-54) and etches the dielectric layer with a recipe comprising CH_4, CHF_3, O_2, and Ar (column 6, lines 55-59). The aforementioned reads on,

A method of fabricating an integrated circuit, comprising:

(a) providing a substrate having an organic anti-reflective coating (OARC) formed on one of a metallic layer and a dielectric layer;

(b) forming a patterned mask on the organic anti-reflective coating (OARC); and

c) etching the organic anti-reflective coating (OARC) using a gas mixture comprising at least one of a hydrocarbon-containing gas and an oxygen-containing gas, **in claim 12**;

wherein the oxygen-containing gas is selected from the group consisting of oxygen (O_2), carbon dioxide (CO_2), carbon monoxide (CO) and sulfur dioxide (SO_2), **in claim 13**;

wherein the hydrocarbon-containing gas has a formula C_xH_y where x and y are integers, **in claim 14**;

wherein the hydrocarbon-containing gas is selected from the group consisting of methane (CH_4), ethylene (C_2H4), ethane (C_2H_6) and ethylyne (C_2H_2), **in claim 15**;

wherein the gas mixture further comprises an inert gas, **in claim 17**; and

wherein the inert gas comprises one or more gases selected from the group consisting of nitrogen (N), argon (Ar), helium (He) and neon (Ne), **in claim 18**.

Since Liu illustrates the same method and materials in etching antireflective coating material then using Liu's method in the same manner as claimed by applicants would result the same wherein the gas mixture comprises the hydrocarbon-containing gas and the inert gas at a hydrocarbon-containing gas:inert gas flow ratio within a range of about 20:1 to about 3:1, **in claim 18**;

wherein the gas mixture comprises the oxygen-containing gas and the inert gas at an oxygen-containing gas:inert gas flow ratio within a range of about 5:1 to about 1:5, **in claim 19**;

wherein step (c) provides an etch selectivity for the organic anti-reflective coating (OARC) over the metallic layer of about 20:1, **in claim 20**; and

wherein step (c) provides an etch selectivity for the organic anti-reflective coating (OARC) over the dielectric layer of about 30:1, **in claim 22**;

wherein step (c) further comprises: providing the hydrocarbon-containing gas and the inert gas at a hydrocarbon-containing gas:inert gas flow ratio of about 20:1 to 3:1; maintaining the substrate at a temperature of about 10 to about 60 degrees Celsius; applying a plasma power of about 500 W to about 1200 W; applying a substrate bias power of about 50 W to about 200 W; and maintaining a process chamber pressure within a range of about 1 mTorr to about 30 mTorr, **in claim 23**; and

wherein step (c) further comprises: providing the oxygen-containing gas and the inert gas at an oxygen-containing gas:inert gas flow ratio of about 5:1 to 1:5; maintaining the substrate at a temperature of about 10 to about 60 degrees Celsius; applying a plasma power of about 500 W to about 1200 W; applying a substrate bias power of about 50 W to about 200 W; and maintaining a process chamber pressure within a range of about 1 mTorr to about 10 mTorr **in claim 24**.

Claim Rejections - 35 USC § 103

8. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Liu (US '158 B1) as applied to claim 12 above, and further in view of Hopper (US 644 B1).

Liu differs in failing to teach the organic anti-reflective coating (OARC) comprises a material selected from the group consisting of polyamide and polysulfone.

Hopper teaches anti-reflective coatings are conventionally made of various materials, including organic and inorganic materials. Organic materials conventionally employed for ARCs include spin-on polyamides and polysulfones. The effective use of an ARC enable patterning, and alignment without reflective interference from the surface of the underlying layer (column 1, lines 49-58).

Hopper illustrates that organic materials such a polyamides and polysulfones, which are used as antireflective coatings are known. Hence, it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to employ Hoppers' antireflective coating to achieve the claimed invention for the purpose preventing interference of light from the surface of an underlying layer.

9. Claims 25-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sui (US 6,559,942 B2) in view of Shi (US '320 B1).

Sui teaches etching a substrate having etch-resistant features (same as applicants' patterned mask) over layers **22** and **24**, in which layer **22** comprises an antireflective layer and is etched in a chamber using CF_4 (column 9, lines 33-34, 48 – column 10, line 12; and column 11, lines). Sui uses a controller **100** that executes a computer-readable process control program **102** on a computer system **104** that comprises a central processor unit **106 and** that is coupled to a memory **108**, which comprises a computer-readable medium (column 12, lines 11-58). The aforementioned reads on,

A computer-readable medium containing software that when executed by a computer causes a semiconductor wafer processing system to etch an organic anti-reflective coating (OARC) using a method, comprising:

(a) providing a substrate having an organic anti-reflective coating (OARC) thereon;

(b) forming a patterned mask on the organic anti-reflective coating (OARC); and

(c) etching the organic anti-reflective coating (OARC)

Sui differs in failing to teach (c) etching the organic anti-reflective coating (OARC) using a gas mixture comprising at least one of a hydrocarbon-containing gas and an oxygen-containing gas, **in claim 25**;

wherein the oxygen-containing gas is selected from the group consisting of oxygen (O_2), carbon dioxide (CO_2), carbon monoxide (CO) and sulfur dioxide (SO_2), **in claim 26**;

wherein the hydrocarbon-containing gas has a formula C_xH_y where x and y are integers, **in claim 27**; and

wherein the hydrocarbon-containing gas is selected from the group consisting of methane (CH_4), ethylene (C_2H4), ethane (C_2H_6) and ethylyne (C_2H_2), **in claim 28**

Shi teaches a method of removing material in a semiconductor structure in which a patterned photoresist layer **18** overlies hardmask layer **16** and insulating material **14** (which is the same as applicants' OARC) and layer **14** comprises organic polymers and is etched using one or more of an inert gas, such as argon, helium, or nitrogen; methane (CH_4); and hydrogen (column 2, lines 30-67).

Since Shi illustrates the specific combination of etchants used to remove an antireflective coating is known, then it would have been obvious to one of ordinary skill in the art at the time the invention was made to select any of the etchants in the Shi reference, including applicants' specifically claimed etchants that would effectively accomplish the disclosed composition.

10. Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sui (US '942 B 2) as applied to claim 25 above, and further in view of Hopper (US '644 B1).

Sui differs in failing to teach the organic anti-reflective coating (OARC) comprises a material selected from the group consisting of polyamide and polysulfone.

Hopper teaches anti-reflective coatings are conventionally made of various materials, including organic and inorganic materials. Organic materials conventionally employed for ARCs include spin-on polyamides and polysulfones. The effective use of an ARC enable patterning, and alignment without reflective interference from the surface of the underlying layer (column 1, lines 49-58).

Hopper illustrates that organic materials such a polyamides and polysulfones, which are used as antireflective coatings are known. Hence, it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to employ Hoppers' antireflective coating to achieve the claimed invention for the purpose preventing interference of light from the surface of an underlying layer.

Conclusion

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Lang et al. (US 849,562 B2) is relied upon to teach low k dielectric film may be used as an anti-reflective coating (Abstract).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lynette T. Umez-Eronini whose telephone number is 571-272-1470. The examiner is normally unavailable on the First Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Art Unit 1765

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September 29, 2005

NADINE G. NORTON
SUPERVISORY PATENT EXAMINER